Claims

1. A method of making a microcapsule, comprising:

activating a fluid ejector at a frequency greater than 10 kilohertz, wherein each activation of said fluid ejector generates essentially a drop, said fluid ejector fluidically coupled to a first fluid including a core component;

ejecting essentially said drop of said first fluid into a second fluid, said drop having a volume; and

generating a microcapsule in said second fluid for each drop of said first fluid ejected, wherein said microcapsule includes said core component.

2. The method in accordance with the method of claim 1, wherein activating said fluid ejector further comprises activating a drop on demand fluid ejector.

3. The method in accordance with the method of claim 2, wherein activating said fluid ejector further comprises:

activating a thermal resistor; and

heating at least one component of said first fluid above the boiling point of said at least one component.

4. The method in accordance with the method of claim 1, wherein activating said fluid ejector actuator further comprises activating a fluid ejector energy generating element n times, ejecting n drops of said first fluid into said second fluid, wherein n is an integer.

5. The method in accordance with the method of claim 4, wherein said n drops produce a distribution of drop volumes within 10 percent of a specified volume.

6. The method in accordance with the method of claim 4, further comprising activating said fluid ejector energy generating element at a steady state producing a distribution of drop volumes within 6 percent of a specified volume.

7. The method in accordance with the method of claim 1, wherein said volume of said drop is in the range from about 1 atto-liter to about 100 pico-liters.

8. The method in accordance with the method of claim 1, wherein said volume of said drop is in the range from about 1 atto-liter to about 1 pico-liters.

9. The method in accordance with the method of claim 1, wherein activating said fluid ejector further comprises activating a thermal resistor.

10. The method in accordance with the method of claim 1, wherein activating said fluid ejector further comprises activating a piezoelectric element.

11. The method in accordance with the method of claim 1, wherein activating said fluid ejector further comprises activating said fluid ejector at a frequency greater than 20 kilohertz.

12. The method in accordance with the method of claim 1, wherein activating said fluid ejector further comprises:

applying an electrical pulse charging a nozzle through which said first fluid is ejected; and

applying a voltage pulse to deflect a pre-selected number of drops.

13. The method in accordance with the method of claim 12, further comprising deflecting a pre-selected number of said drops into a recirculator.

14. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting said drop a pre-selected distance above the surface of said second fluid.

15. The method in accordance with the method of claim 14. further comprising ejecting said drop of said first fluid into a thin liquid film of said second fluid.

16. The method in accordance with the method of claim 15, further comprising flowing said thin liquid film of said second fluid in a direction perpendicular to a fluid ejection axis of a fluid ejector head.

17. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting said drop of said first fluid from a chamber through at least one nozzle formed in a nozzle layer, said chamber and said at least one nozzle each having a volume, wherein said volume of said chamber is greater than said volume of said nozzle.

18. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting said drop of said first fluid from at least one nozzle formed in a nozzle layer.

19. The method in accordance with the method of claim 18, further comprising immersing said at least one nozzle wherein at least a portion of said nozzle layer is below the surface of said second fluid.

20. The method in accordance with the method of claim 19, further comprising flowing said second fluid in a direction perpendicular to a fluid ejection axis of a fluid ejector head.

21. The method in accordance with the method of claim 1, further comprising:

moving said fluid ejector in at least one lateral direction over said second fluid;

activating said fluid ejector at pre-selected lateral locations; and

ejecting essentially a drop of said first fluid into said second fluid at each pre-selected lateral location.

22. The method in accordance with the method of claim 20, wherein moving said fluid ejector further comprises reciprocally translating said fluid ejector over said second fluid.

23. The method in accordance with the method of claim 1, further comprising flowing said second fluid in a thin film in a direction perpendicular to a fluid ejection axis of said fluid ejector.

24. The method in accordance with the method of claim 1, further comprising:

moving said fluid ejector in at least one lateral direction in said second fluid;

activating said fluid ejector at pre-selected lateral locations; and

ejecting essentially a drop of said first fluid into said second fluid at each pre-selected lateral location.

25. The method in accordance with the method of claim 20, wherein moving said fluid ejector further comprises reciprocally translating said fluid ejector in a lateral direction in said second fluid.

26. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting essentially said drop of said first fluid into a mist of said second fluid.

27. The method in accordance with the method of claim 26, further comprising:

activating a plurality of second fluid ejectors fluidically coupled to said second fluid;

ejecting multiple second fluid drops of said second fluid proximate to said drop of said first fluid; and

generating said mist of said second fluid.

28. The method in accordance with the method of claim 27, wherein said multiple second fluid drops of said second fluid produce a distribution of second fluid drop volumes within 10 percent of a specified second fluid drop volume.

29. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting said drop of said first fluid having a polyanion, wherein said core component is dispersed in said first fluid.

30. The method in accordance with the method of claim 1, wherein ejecting said first drop further comprises ejecting a drop of a first fluid immiscible with said second fluid.

31. The method in accordance with the method of claim 1, wherein said core component includes a bioactive agent.

32. The method in accordance with the method of claim 1, wherein ejecting said drop further comprises ejecting a drop of a first fluid including said core component and a monomer into a second fluid that includes a co-reactant to said monomer.

33. The method in accordance with the method of claim 32, further comprising reacting said monomer and said co-reactant to form a polymer shell encapsulating said core component.

34. The method in accordance with the method of claim 1, wherein said core component includes hemoglobin.

35. The method in accordance with the method of claim 1, wherein said core component includes a red blood cell.

36. The method in accordance with the method of claim 1, wherein said core component includes a living cell.

37. The method in accordance with the method of claim 1, wherein said core component includes a protein.

38. The method in accordance with the method of claim 1, wherein said core component includes a peptide.

39. The method in accordance with the method of claim 1, wherein generating a microcapsule further comprises generating a chitosan alkali metal alginate microcapsule.

40. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises forming a coacervate.

41. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises encapsulating hemoglobin.

42. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises encapsulating red blood cells.

43. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises encapsulating a living cell.

44. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises encapsulating a protein.

45. The method in accordance with the method of claim 1, wherein generating said microcapsule further comprises encapsulating a peptide.

46. A method of making a microcapsule, comprising:

activating n times a drop-on-demand fluid ejector, said fluid ejector fluidically coupled to a first fluid including a core component, said fluid ejector operated at a frequency greater than 10 kilohertz, wherein each activation generates essentially a fluid drop of said first fluid;

ejecting essentially n drops of said first fluid into a second fluid producing a distribution of n fluid drop volumes, wherein each drop volume of said n fluid drops is within about 10 percent of a specified drop volume; and

generating a microcapsule in said second fluid, wherein said microcapsule includes said core component.

47. A method of using a drop on demand fluid ejection device, comprising:

energizing the drop on demand fluid ejection device;

ejecting essentially a drop of a first fluid including a microcapsule forming core component into a second fluid; and

generating a microcapsule in said second fluid, wherein said microcapsule includes said microcapsule forming core component.

48. The method in accordance with the method of claim 47, wherein energizing the fluid ejection device further comprises energizing a thermally activated fluid ejection device.

49. The method in accordance with the method of claim 47, further comprising positioning the fluid ejection device a pre-selected distance above said second fluid.

50. The method in accordance with the method of claim 47, further comprising immersing the fluid ejection device a pre-selected distance in said second fluid.

51. The method in accordance with the method of claim 47, further comprising flowing said second fluid in a direction perpendicular to a fluid ejection axis of the fluid ejection device.

52. The method in accordance with the method of claim 51, further comprising:

moving the fluid ejection device in at least one lateral direction in said second fluid; and

ejecting n drops of said first fluid into said second fluid at n pre-selected lateral locations.

53. The method in accordance with the method of claim 51, further comprising:

moving the fluid ejection device in at least one lateral direction over said second fluid; and

ejecting n drops of said first fluid into said second fluid at n pre-selected lateral locations.

54. The method in accordance with the method of claim 53, wherein moving said fluid ejector further comprises reciprocally translating said fluid ejector over said second fluid.

55. The method in accordance with the method of claim 53, further comprising flowing said second fluid in a thin film in a direction perpendicular to a fluid ejection axis of said fluid ejector.

56. The method in accordance with the method of claim 47, wherein ejecting said drop further comprises ejecting said drop of said first fluid having a polyanion, wherein said core component is dispersed in said first fluid.

57. The method in accordance with the method of claim 47, wherein ejecting said first drop further comprises ejecting a drop of a first fluid immiscible with said second fluid.

58. The method in accordance with the method of claim 47, wherein said core component includes a bioactive agent.

59. The method in accordance with the method of claim 47, wherein ejecting said drop further comprises ejecting a drop of a first fluid including said core component and a monomer into a second fluid that includes a co-reactant to said monomer.

60. The method in accordance with the method of claim 59, further comprising reacting said monomer and said co-reactant to form a polymer shell encapsulating said core component.

61. The method in accordance with the method of claim 47, wherein said core component includes hemoglobin.

62. The method in accordance with the method of claim 47, wherein said core component includes a red blood cell.

63. The method in accordance with the method of claim 47, wherein said core component includes a living cell.

64. The method in accordance with the method of claim 47, wherein said core component includes a protein.

65. The method in accordance with the method of claim 47, wherein said core component includes a peptide.

66. The method in accordance with the method of claim 47, wherein generating a microcapsule further comprises generating a chitosan alkali metal alginate microcapsule.

67. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises forming a coacervate.

68. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises encapsulating hemoglobin.

69. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises encapsulating red blood cells.

70. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises encapsulating a living cell.

71. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises encapsulating a protein.

72. The method in accordance with the method of claim 47, wherein generating said microcapsule further comprises encapsulating a peptide.